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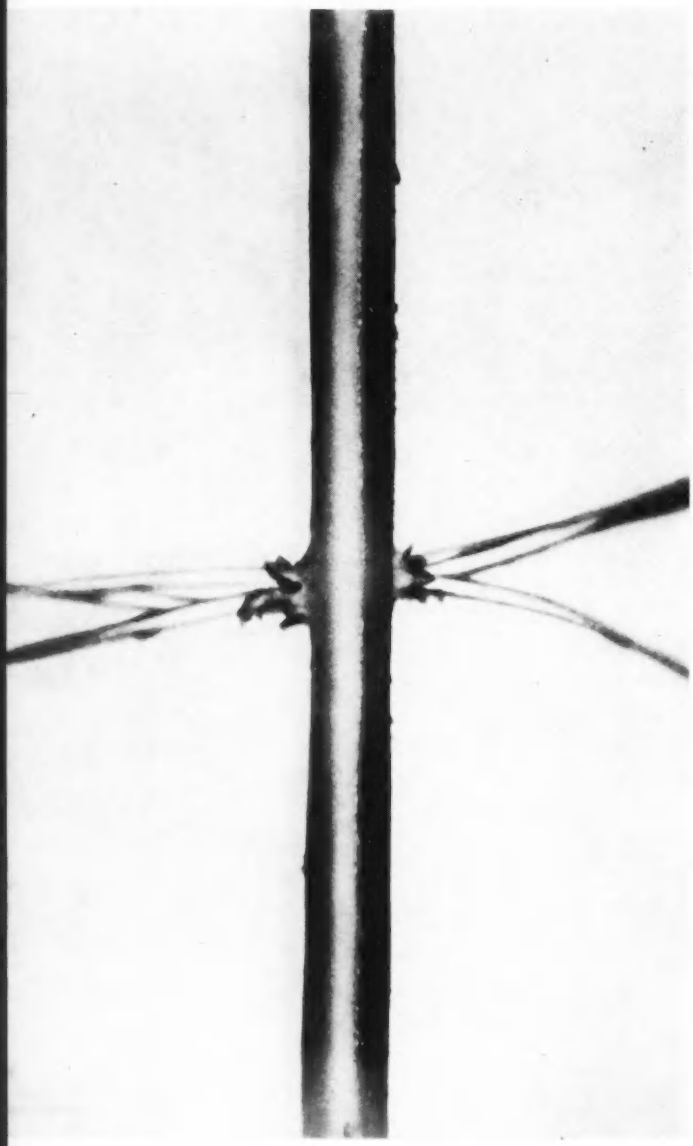
concrete construction

ARTICLES



We're Modestly Proud

If someone offers to bet you that he can bore a hole through an ordinary human hair, and then string through that hole a strand of copper wire, you'd be justified in assuming he is either drunk or crazy. But don't be too quick to cover his bet. If he has the proper equipment and skill, he can not only make good his boast, but he can thread two extra wires through the hole just to show you how mistaken you were!

We don't know whether or not there is any future in threading wires through hairs, but our point is that the proper equipment and skill can be the means of solving many problems, whether you're talking about making a motor for the world's first electric wrist watch (the job for which the wire in the photomicrograph was developed), or the production and delivery of ready mixed concrete. While the motor-driven electric wrist watch intrigues us a good deal, we're a lot more interested in ready mixed concrete because our particular skills have been concentrated on the truck mixers in which so much of this basic material of construction is produced and delivered today.

We KNOW that the ready mixed concrete producer who operates well-maintained Rocket or Hi-Lo truck mixers is excellently equipped to do the job he has undertaken, for this is the only way in the world that he and we can stay in business. We must both contrive month in and month out to meet the high standards that you, the user of ready mix, insist upon—and we're modestly proud to be able to say that we've been doing just that for over 30 years.

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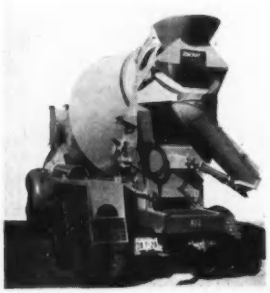

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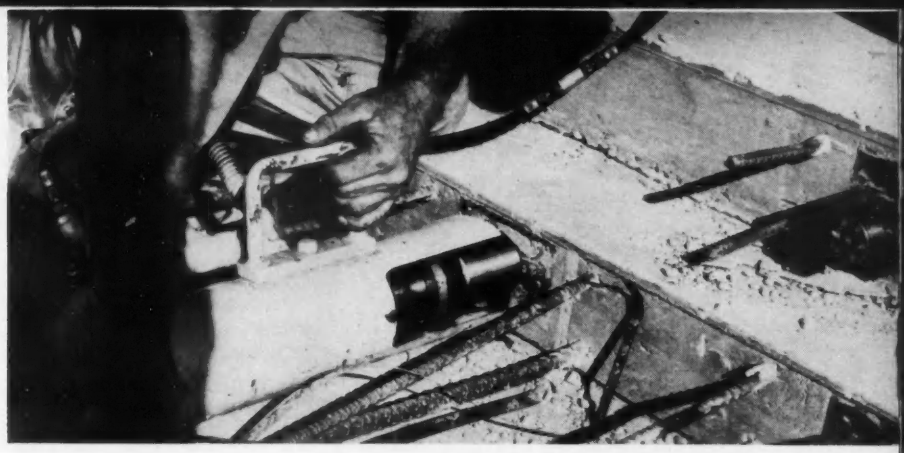
A look at prestressing

—what it is and how far

it has come in America



PRESTRESSED CONCRETE TODAY

A DECADE AGO PRESTRESSED CONCRETE burst onto the American construction scene with unprecedented, pent-up vigor. Ordinarily a decade is hardly sufficient time to justify a review of progress when dealing with a sweeping new design and construction technique. However, in the case of prestressing there is already ample progress to make such a survey valid and worthwhile.

In the United States prestressed concrete made a tardy appearance. This delayed entrance was caused by a number of circumstances, both economic and technical. Although the basic concept of prestressing had been originated and patented by an American engineer last century, it was not generally employed here until approximately ten years ago. In the meantime, Europeans had developed the concept to a point of refinement that made possible the phenomenal acceptance it has enjoyed stateside. Naturally, foreign developments had to be adapted to conditions in the United States; but the fact remains that when American construction finally gave birth to our prestressing industry, it delivered a baby of unusual power and stamina.

how it works

To understand better how this idea was able to capture the confidence of so many in so short a time, let's contrast it with conventional construction.

If we were to impose a uniform load upon a simply supported beam of unreinforced concrete, the beam would deflect downward with the maximum deflection occurring at mid-span. (See Beam 1.) As the beam became progressively deformed by this action, the concrete would be subjected to compressive (squeezing) stresses at the top and tensile (stretching) forces at the base of the beam. This is basically the reaction to loading of a beam of any type of construction material, whether it is concrete, steel or wood.

Concrete can be obtained in compressive strengths up to 18,000 psi under highly special conditions. However, the tensile strength of even the best concrete is low—somewhere near 500-600 psi. For reinforced concrete structural design purposes, it is generally assumed to have a compressive strength of 3,000-3,500 psi and a tensile strength of zero. (Structural steel is assumed for design purposes to have a strength of 20,000 psi for both compression and tension in many cases.)

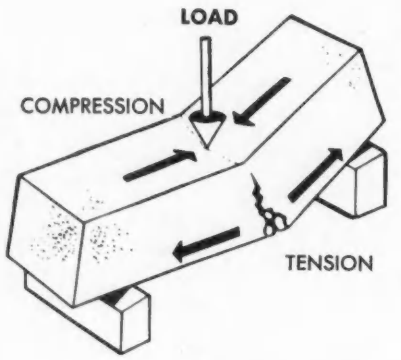
As can readily be appreciated, the unreinforced concrete beam undergoing deflection would literally be torn apart at its base under even light loading. This explains why unreinforced concrete can only be used in certain pavement work, where the subgrade provides the structural strength, or in mass work, as in dams.

To prevent such cracking of concrete beams, steel bars are buried in the members. (See Beam 3.) This reinforcement is concentrated near the bottom of the girder, where most of the tensile stresses will be encountered. Then, as loads are applied, the beam begins to deflect. As the base of the girder lengthens, the stress is transferred to the steel bars, bonded to the concrete, which can easily handle tensile forces of the magnitude encountered under these conditions. This combination of concrete for compression and steel for tension has and is still being used for construction of amazing diversity throughout the world.

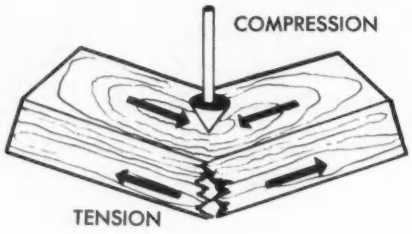
Despite the many advantages of reinforced concrete, it has been recognized for many years that it has distinct shortcomings in terms of the efficiency with which it uses materials. As has been stated, tensile stresses are passed on to the steel bars by the lengthening of the concrete member. Naturally, the concrete stretches somewhat before the bars begin to act. This stretching of the concrete causes cracks to form in the base of the beam. For example, in a rectangular reinforced concrete beam, merely the top one-third is considered to be free from cracks and therefore capable of supporting loads. In other words, two-thirds of the concrete is not contributing to the structural strength of the member and the steel is being used for tensile stresses far below those it can handle.

If higher strength reinforcement was used, it would not begin absorbing the tensile stresses until the concrete has deflected (and cracked) even more. The tensile strength of concrete does not materially rise, even in extremely high compressive strength mixes. Much study has been devoted to these points with the result that the design and construction of reinforced concrete structures and pavements are highly sophisticated. Design theories have been developed and polished to provide accurate, rapid means of engineering structures. Girder shapes have been evolved that reduce the amount of "dead-weight" material. Shell roofs are being built that further heighten the efficiency of the use of materials.

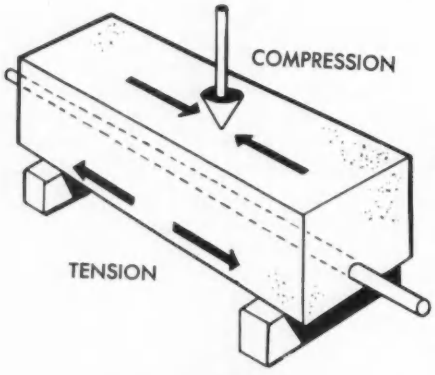
(MORE)



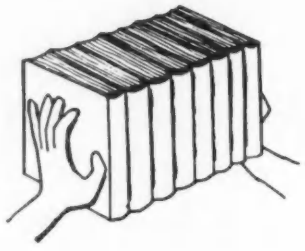
1. **Simple concrete beam, under enough load, will bend and crack.**



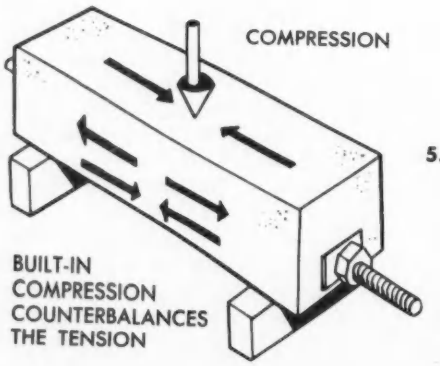
2. **Concrete under load acts like wood. Top is compressed, bottom cracks.**



3. **Steel rod can take tension in bottom of concrete beam. Top takes compression. For smarter design . . .**



4. **Squeeze can be used as in lifting books. Applied to concrete, that idea is . . .**



5. **Prestressing. High-strength cable, under high tension, strengthens beam, prevents cracking.**

Reinforcement deformation has been originated and improved to achieve transference of the tensile forces in as short a time as possible after loading. The effects of size and arrangement of reinforcement bars have been studied to lessen cracking.

Effective as these developments have been in rendering concrete highly competitive with other construction materials, they minimize rather than eliminate the basic drawbacks.

Men had been searching for many years for a means of building with concrete which would not be so wasteful of materials. As early as the 1800's the basic concept of prestressing had been proposed as a way of avoiding the disadvantages inherent in reinforced concrete construction. However, high strength steels were not available at that time and the idea, though sound in theory, proved unworkable in practice. With the advent of the high tensile strength steels of today, prestressing moved from the sphere of conjecture to the world of actual application.

Since concrete is strong in compression and weak in tension, the problem boiled down to devising a technique whereby all of the concrete would be in compression and, therefore, crackfree. In prestressing, this is accomplished by embedding high strength steel cables in the concrete member, stretching the steel (usually by hydraulic jacks) and using the force exerted by the cables trying to return to their former length and thickness to compress the concrete in the beam. Most of the cables are placed near the bottom of members because tensile stresses are concentrated there. Often, however, some cables are positioned in the middle and top to control camber and prevent any tensile stresses from developing at the top of the member before loading occurs.

The steel in the concrete no longer acts as reinforcement, that is, a means of accommodating tensile forces. It is now used to remove the possibility of any tension developing in the beam by setting up forces within the beam which are exactly the opposite to those which it will experience when it is loaded. Consequently, when loads are applied, an equilibrium is achieved. You might say that prestressing causes a girder to arc up in the middle; and loading then forces it down to its former straight line shape. The only

time that prestressing cables assume characteristics of reinforcement is when the beam is greatly overloaded and the cables are stretched.

when to jack?

Two important alternatives are available in prestressing—pretensioning and post-tensioning. In pretensioning work, the cables are jacked or stretched before the concrete has been cast. Conversely, in post-tensioning the cables are jacked after the concrete has hardened.

Post-tensioning holds sway in Europe as the preferred approach. Building codes and a daring more practical overseas permit longer spans and heavier loads than in the United States. The longer, heavier girders render post-tensioning the logical choice since such bulky members are most economically cast on the job site.

In this country, labor costs made production-line fabrication the desired goal. Thanks to the ingenuity and inventiveness of American engineers and contractors, the goal has been reached much earlier than had even been hoped for. The hundreds of prestressing plants throughout America now turning out a wide variety of building components, bridge beams and other products attest to this.

Recently, however, a new trend has been gathering force. This is the use of precast-pretensioned products cast on the job site. Wrinkles still wait to be ironed out in this field but it gives every promise of developing into a commonplace. Especially on large jobs has it proven profitable. In the recent construction of a 100,000-square foot warehouse for General Electric, the contractor elected to set up beds at the job site and cast and pretension the roof girders and double-tee units. In addition to the profits earned by casting the units himself, the contractor saved $25,000 in transportation charges. Beds for this job were designed so that they could easily be dismantled and reassembled at other jobs where savings would be even more pronounced.

Post-tensioning enjoys an important advantage over pretensioning in that strands can easily be curved to complement the stress patterns of the members. As you have undoubtedly noticed, when a girder is heavily loaded it deflects the greatest amount at midspan, with reducing amounts to the ends of the unit. As has been stated, prestressing aims at setting up forces exactly the opposite of those which will be encountered when loading occurs. To most closely achieve this aim, the cables must be positioned near the bottom of the girder at midspan and proportionately higher as the stresses decrease near the ends. In post-tensioning, it is relatively simple to drape the cables in a catenary curve (the curve assumed by a rope when supported at two level points). This exactly matches the needs dictated by the stresses.

The 120-foot highway bridges which were site-cast and post-tensioned at Air Force Academy project in Colorado demonstrate an economical means of handling large prestressed members. Note the draped cables over the casting bed at the left.

One can easily see that problems will arise when cables not in a straight line are to be jacked before the concrete is cast. In casting small units, this problem is not important enough to warrant consideration. However, when long spans and heavy loading is encountered, it is an important matter. Fortunately, means have been developed to "harp" the cables (hold them to an approximate catenary curve). Hold-down devices are available that pull the cables down at two or more points. "Push-down" units also on the market are composed of a yoke over the forms from which extend bars that hold the cables down.

advantages

The sweeping acceptance accorded prestressed concrete speaks eloquently of its inherent advantages. Prestressed units are free from cracks. Since they are without tensile stresses, the units retain their integrity indefinitely. Some difficulty has been encountered at the ends of prestressed members, for example, girder end blocks. However, this cracking is minor and ways are being developed to prevent it.

During load tests of prestressed members, persons unfamiliar with this new construction material are often amazed at the great deflection that occurs before actual failure. Actually, this characteristic is one of prestressing's most important advantages. It has the ability to a remarkable degree to recover from overloads. Prestressed members can be caused to deflect over half a foot and still return to virtually their identical original shape when the overload is removed. Since almost all building and bridge components are called upon occasionally to support loads over those for which they were designed, this characteristic of prestressing means better performing structures.

Among the by-products of prestressing is the high durability of prestressed units. Since high early strength concretes are a necesary factor, the concrete is bound to have the increased weatherability which goes along with a low water cement ratio and well placed and cured concrete. Also, the absence of cracks from prestressed members reduces spalling and other deteriorating and unsightly damage.

(MORE)

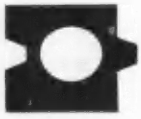
Because greater efficiency in the use of high quality materials is possible with prestressing, it offers longer spans, smaller members and greater load-carrying capacity. A decided advantage steel has long had over concrete has been its much higher strength weight ratio—in ordinary reinforced concrete it is only one-quarter to one-third that of steel. With the higher strength materials of prestressing, this is brought to over one-half. In the future, an even higher ratio for prestressed concrete can be expected.

And last, but certainly not least, is the matter of economy. Competitive materials have been put on their mettle to match bids when pitted against prestressed concrete construction. Trade magazines and even newspapers carry scores of items each month in which cases of the economy of prestressing are dramatically pointed out.

Typical Prestressed Building Component Shapes

I-BEAM: popular shape widely used for sizeable spans in both buildings and bridges.

MODIFIED I-BEAM: often employed when slab is to be cast composite with beam, as in bridge superstructures.



CORED SLAB: lightweight members (often patented) commonly used for floor and roof units.

DOUBLE-TEE: most popular of building component shapes. Combines beam and slab in one unit. Spans to over 100 feet. Many variations.

CHANNEL: a double-tee unit without the over-hanging slab. Supports heavier loads. Used both for bridges and buildings.

SINGLE-TEE: this variation of the double-tee permits great flexibility in erection and design.

SINGLE-WING TEE: another variation of the double-tee. This one eliminates exposed joints in the ceiling and cuts down on leaking.

applications

Prestressing was used in this country as early as the thirties but it was almost entirely limited to the construction of pipe and tanks. The sight of a merry-go-round cable winding and stressing machine circling large tanks is no longer the novelty that it once was.

It wasn't until the forties, however, that rumbles of the expansion of prestressing into linear work began to gather on the U.S. construction scene. Just before this decade (in 1949) linear prestressing gained national publicity with the construction of the Walnut Lane Bridge in Philadelphia, Pa. Its 160-foot center span dramatically illustrated to American engineers that prestressing was an entirely workable technique.

Although bridges dominated the prestressing market for several years, there has lately been an encouraging sign of its being used in many other applications. Even now its use in building products, such as roof and floor plank and roof girders, has at least equaled the bridge market. Developments in this field are coming fast and furious now. The dominance of even the double-tee and channel is being challenged by such newcomers as the single-wing tee and the single-tee.

In piling, prestressing has made a deep inroad because it offers greatly enhanced characteristics in transportation, driving and in-ground performance.

Thin shell roofs are also benefited by prestressing. Cables can be either in the edge beam or the shell itself. Prestressing enables longer spans to be realized, controls deflection and imparts a lighter appearance to the shell by permitting a reduction in the size of the edge beam. Post-tensioning lift slabs means that spans can be longer and slabs lighter—both of which reduce costs in the lifting operation.

the future

Recognizing that prestressing is barely a decade old in this country as far as general usage is concerned, it is amazing that it has gained the many markets that it has. Now that

the Prestressed Concrete Institute has swung into high gear on a national scale and other institutions are stepping up their work in this field, we can logically expect even greater expansion in the coming years.

Work is nearing completion in compounding both a nationally recognized building code and fire ratings. Development and study of new girder shapes, cable designs, design techniques, means of achieving continuity, etc., will undoubtedly further reduce the cost and extend the application of prestressing.

The band wagon is well under way and the crowd is jumping on in droves. Prestressing's first decade in America has been sweeping; its second should be even more decisive. END

Prestressed Concrete Terminology

BED: the form and abutments that are used to cast prestressed products. Forms must be rugged to withstand many reuses. Abutments through which the prestressing cables pass and against which they bear until the concrete has hardened, have to be able to withstand the tremendous pressures exerted by the jacks.

CABLE: a composite of several extra high-strength wires.

CAMBER: an arc-shaped deflection with greatest magnitude at mid-span. Caused by prestressing forces introduced in the base of members.

CATENARY EFFECT: both tensile and compressive forces are least severe at the ends of a beam and most severe in the middle. In view of this, full advantage is taken of prestressing cables only when they are draped in a catenary curve (the curve a flexible piece of rope would assume when held at both ends). This is referred to as the catenary effect.

COMPRESSIVE STRENGTH: resistance to squeezing forces.

CONTINUITY: monolithic action achieved by tying together butting girders. Continuity considerably improves the performance of structures.

CREEP: the tendency of elastic materials, e.g., concrete and steel, to "give" or "relax" slightly under continued stress. Causes reduction in prestressing force which must be taken into consideration in the design.

DEAD LOAD: weight that a member must be expected to support at all times, e.g., its own weight and that of roof topping, walls, etc.

DESIGN LOAD: weight which unit was planned to support.

DRAPING: positioning of prestressing cables in the shape of a catenary curve. Possible in post-tensioning work.

END ANCHORAGE: device at each end of a post-tensioned unit which holds cables at proper tension.

END BLOCK: thickening at ends of girders. End blocks raise the cost of beam fabrication. Means have been evolved to dispense with them in many prestressed members.

HARPING: positioning of prestressing cables in approximately a catenary curve by deflecting devices at two or more places. Used in pretensioning work.

LIVE LOAD: weight of a temporary nature that members are expected to support, e.g., snow, wind, people and vehicles.

MILD STEEL: term used for medium tensile strength steel used in concrete reinforcement, in contrast with high yield point steel used for prestressing cables.

RECOVERY: ability of a member to return to its original shape after it has been deflected.

SERVICE LOAD: dead load plus live load.

SIMPLY SUPPORTED: said of beams which are not interconnected with adjacent members but merely bearing on two supports. As contrasted with continuity.

STRAND: a factory-produced unit of helically-wound, small-diameter wires.

TENSILE STRENGTH: resistance to stretching forces.

ULTIMATE LOAD: least weight under which a member will fail.

YIELD POINT: smallest amount of stretching from which a cable will not be able to snap back to approximately its original length.

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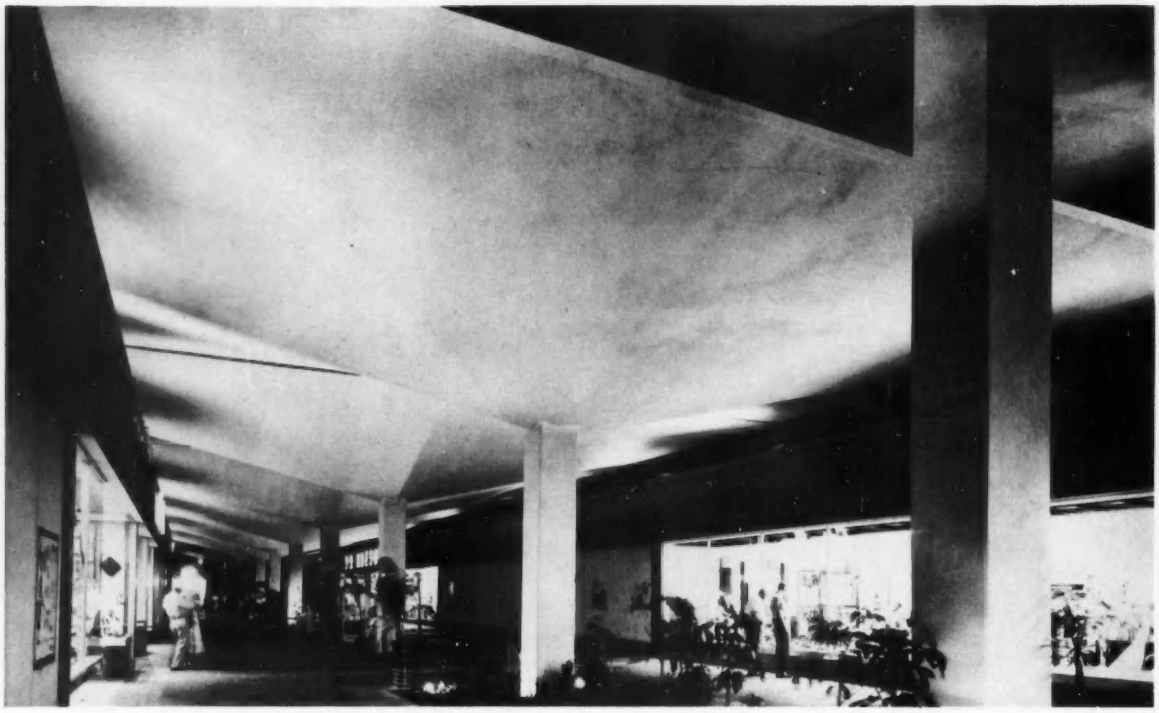


Cortez Shopping Center, Bradenton, Florida, was constructed using the newly offered standardized hyperbolic paraboloid shells.

NOW! SHELL ROOFS IN STOCK

FILE: Thin Shell

THE UNUSUAL HAS A GLAMOUR all its own. Unfortunately, the unusual in construction in the United States almost always means a considerably higher cost. With labor salaries at their present level, low cost construction must make use of standardized components. Shell roofs have given promise of defying this tradition by combining exotic beauty with low cost, when sufficient reuses of the expensive forms can be obtained.

As was pointed out in our article on hyperbolic paraboloid shell roofs early this year*, the h/p shell has a promising future because it offers unusual beauty, impressive spans and relatively low cost. Now a Florida firm *(West Coast Shell Corporation, Sarasota)* has announced that it is offering a service whereby it will cast h/p shells in a variety of stock sizes on any jobsite in the United States. Engineers of the firm calculate the footing size applicable to the soil-bearing capacity at the project site. They then cast the footings, columns and shells in stock forms. Available shell sizes range from 8 feet by 10 feet to 100 feet square.

Because utmost form reusage is obtained, prices are tempting. Costs vary depending on soil-bearing capacity, spans, etc., but an average roof amounts to approximately $2.50 per square foot of roof in place. Several buildings have already been built using this new service.

Another Florida concern *(Holloway Concrete Products, Winter Park)* is offering standardized precast 48-foot long barrel shells. Other standard sizes are being developed. Domed skylights are cast in the lightweight concrete shells. A number of buildings are under construction with these shells and silos have also been constructed by banding together the barrel shells.

Standardized shell roofs appear to offer many promising advantages. They are one more instance where the cause of concrete construction is being greatly stimulated by the introduction of new techniques which benefit owner, contractor, architect and engineer alike.

END

*The Hyperbolic Paraboloid, *Concrete Construction*; January 1959.

BUILDING WINTER RESISTANCE INTO CONCRETE

BY FRED F. BARTEL*

THE SEVERE WINTER of 1958-59 has brought home to many users and producers of concrete the need for concrete structures having the best resistance to freezing and thawing and to salts used for snow and ice removal. Never before has so much damage been done to concrete. The need is especially critical in the case of pavements, curbs, sidewalks, garage slabs, porch stoops and other flat construction which is most subject to such attack.

The increasing use of salt (both sodium and calcium chlorides) for snow and ice removal especially has resulted in an increasingly large number of scaled slabs. The City of Milwaukee, as a case in point, used about 20,000 tons of salt during the winter of 1958-59, or more than twice the amount ever used before, to keep pavements free of ice and snow. The announced policy is to salt streets for any snow-fall from ¼ inch to any depth even if full-scale plowing operations are in order; it has been found that salting prior to plowing permits easier complete removal of snow and ice. Other government agencies in northern United States have adopted similar policies. Much of the salt used on public streets is picked up under fenders and bodies of automobiles and later drips off and accumulates on driveways and garage slabs causing deterioration of concrete even where owners themselves do not use salt.

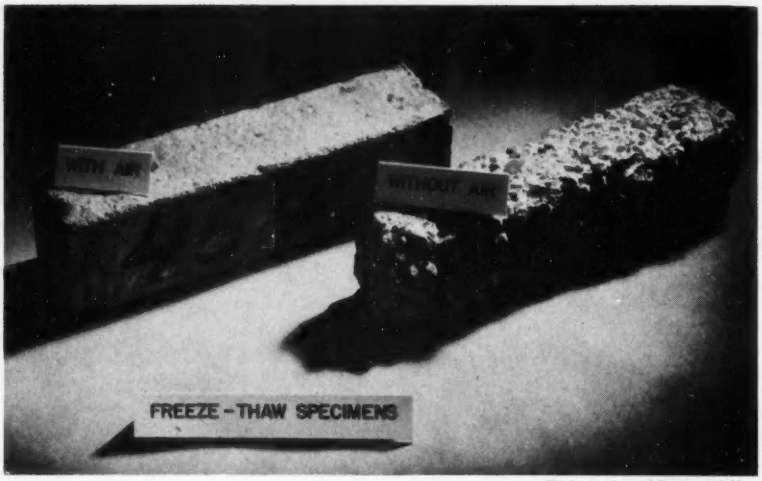
Under these conditions, it is highly important that construction practices be re-examined so that concrete which will be durable can be produced. What formerly was considered "good practice" may no longer be acceptable. The following recommendations are made to improve resistance of concrete to severe weathering and to deicer salts:

(1) Use air-entrained concrete. This is a **must** for all concrete which may come in contact with salt or may be subjected to freezing and thawing in the presence of moisture, e.g., pavements, driveways, sidewalks, curb and gutter, garage slabs, porch stoops, etc.

(2) Use air-entrained concrete containing a minimum of 5½ bags of cement per cubic yard—preferably 6 bags. At one time in many areas, 5-bag concrete was considered adequate but exposures are now more severe and State Highway Departments and others are pretty generally using 6 bags of cement per cubic yard.

(3) Use medium consistency air-entrained concrete. Do not use wet, sloppy concrete which is inherently

*Chief Engineer, Tews Lime & Cement Co., Milwaukee, Wis.



Two test blocks of concrete, one with entrained air and the other without, after 50 freeze-thaw cycles.

Photo courtesy of Dewey and Almy

weak and has low durability. Concrete should be placed as dry as it can be handled, satisfactorily compacted, and finished.

(4) Protect soft, fresh air-entrained concrete from rainfall and do not spray or sprinkle it with water to permit easier finishing. Experience has shown that water applied to soft concrete will remove entrained air from the top layer where it is needed most.

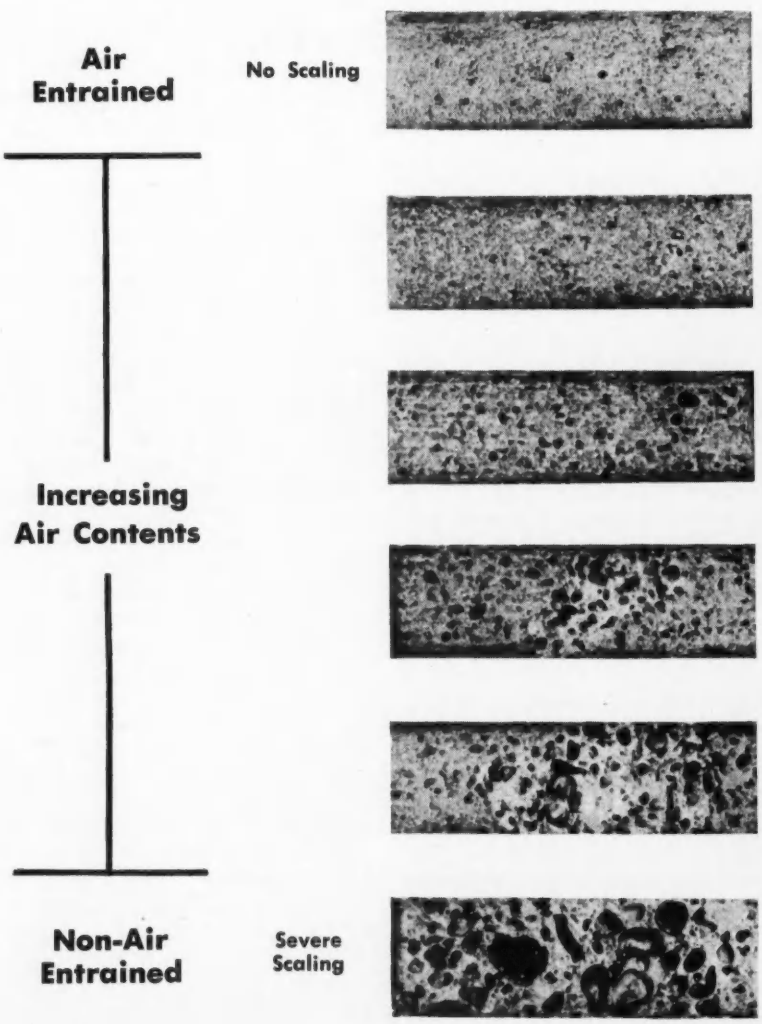
(5) Avoid over-finishing. Over finishing of concrete, particularly when it is too soft, brings excessive quantities of fines and water to the surface. One trowelling followed by brushing should satisfy the most particular owner.

(6) Cure the concrete. After finishing has been completed, protect the concrete from rapid drying of the surface and low temperatures. The use of a curing compound, covering with sisal-kraft paper, or spraying with water will inhibit evaporation of water from the fresh concrete. Concrete should be protected from freezing temperatures until it has been adequately moist-cured to produce strength, followed by drying to remove excessive amounts of internal water. It is extremely hazardous to construct outside work after November 1 in northern United States without fairly elaborate precautions to protect the concrete.

If the above practices are followed, resistance to freezing and thawing and to salts used for snow and ice removal should be maximum without increasing costs of construction excessively.

END

Entrained Air vs Scaling



concrete construction highlights

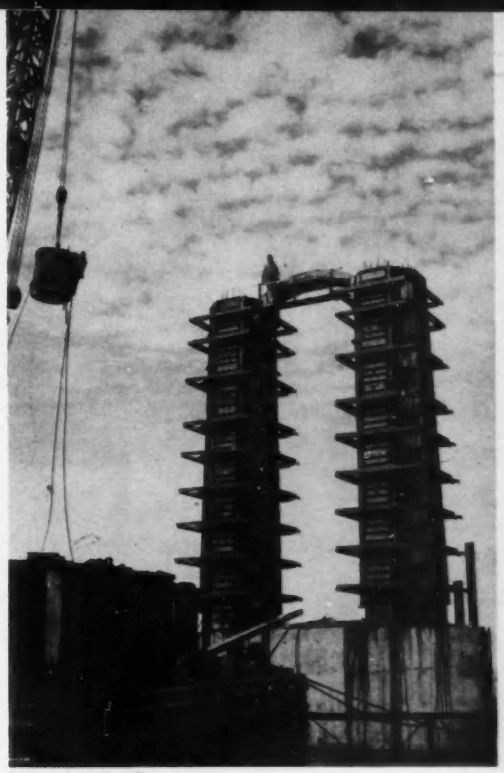
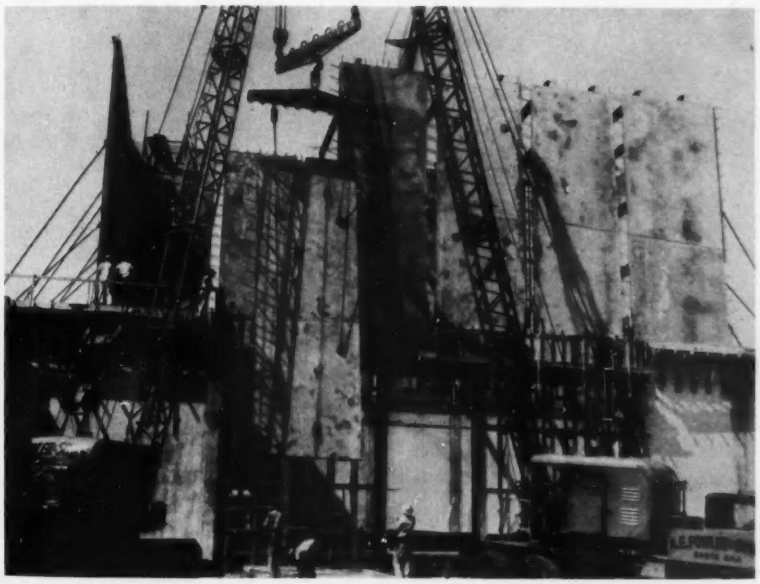


Photo courtesy Blaw-Knox Co.

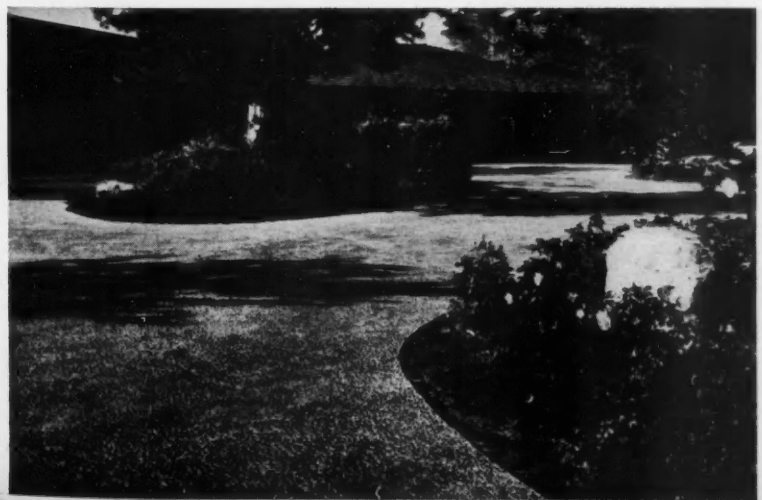
look, ma, no tie rods!

Single lift placement of concrete and the elimination of construction joints are among the noteworthy features of the massive concrete piers for the $22,000,000 international bridge under construction over the St. Lawrence River near Ogdensburg, New York. The substructure includes five land piers and 28 water piers. Although the pier forms support single lifts of concrete as high as 41 feet, heavy structural members resist the extreme pressures (more than 2,000 pounds per square foot) exerted by the concrete without the aid of tie rods. Despite the massiveness of the forms, stripping and repositioning of the 20-ton units for subsequent pours was accomplished in only 8 hours. Concrete was placed at a rate of 1,000 cubic yards per hour and cured for 24 hours before stripping. A total of 70,000 cubic yards of concrete was required for all structural work.



panels take to the air

The dead load of the tilt-up panel, shown here as it was being lifted into position 60 feet above grade, was reduced from 26 tons to 17 tons by the substitution of an expanded shale aggregate for conventional heavyweight aggregate. The weight savings not only made it possible to handle the outsize panels with an extension boom, but also accomplished a much-to-be desired reduction in the seismic concentration overhead. The Rocklite aggregate used for the panels reduced the weight of the concrete about 50 pounds per cubic foot without affecting its strength. The unusually large tilt-up panels are for a high school in Santa Ana, California. Lightweight concrete was also used for the roof slab.



glamorous driveway

This pebbled concrete driveway incorporates color and texture effects which cannot be achieved in any other way or with any other material. The pebble topping is scattered thickly over plastic concrete, tamped into the surface, and then worked smooth with a wooden template. The surface is then sprayed with a retarder and the top layer of cement paste is later removed by brushing and washing.

SLAB-ON-GROUND CONSTRUCTION

Here are some simple procedures and minimum standards which can assure good results from what was once considered a tricky type of concrete construction.

FILE: Slabs

EDITOR'S NOTE

We have just received a newly published report entitled "Protection From Moisture for Slab-on-Ground Construction and for Habitable Spaces Below Grade" which we believe readers would find informative. This is Report No. 15 to the Federal Housing Administration, by the Building Research Advisory Board, Division of Engineering and Industrial Research, prepared and edited by William S. Brown, Staff Architect, Publication 707, National Academy of Sciences—National Research Council, 2101 Constitution Avenue, Washington 25, D. C. 67 pp. $1.50.

ALTHOUGH THIS MAGAZINE has published several articles* expressing a rather strong bias toward basement-type residential construction, it is recognized that for economy reasons there will always exist a demand in some areas for slab-on-ground construction. Because the construction of concrete floors on the ground necessarily focuses a great deal of attention on the performance of concrete, especially when the results of such construction are less than satisfactory, the concrete industry has the strongest incentives for doing everything possible to encourage the highest standards of workmanship. This is particularly true since the shortcomings of most slab-on-ground construction have far more to do with faults or oversights of workmanship than to inherent shortcomings in concrete itself.

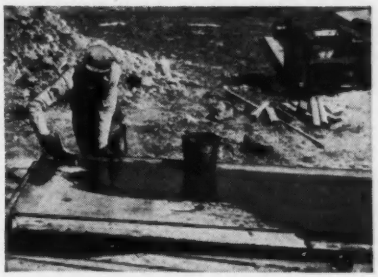
The purpose of this article is to call attention to some of the aspects of this type of construction which are most likely to cause trouble, and to suggest some precautions which the builder can observe to assure better results and thus protect himself and his product from criticism. Most of the recommendations discussed here

*Bring Back the Basement! Jan. 1957, p. 8; and Step Down to More Living Space, Sept. 1959, p. 6.

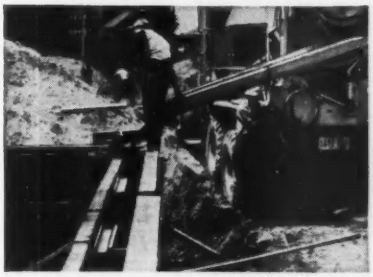
Concrete basements stay dry when builders follow these rules

It's easier to build a dry basement than to repair a leaky one afterward. Here is how to build leak-proof, cast-in-place walls to make a dry concrete basement.

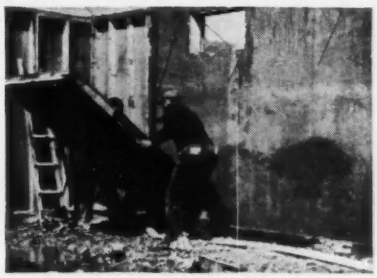
Place footings on firm soil below the frost line, following building code requirements. If no code applies, make the footing as thick as the wall and twice as wide.



Use sound forms, well braced, for walls that are true to line and grade. If re-using forms, be sure panels are carefully cleaned, then oiled, soaped or lacquered on inside surfaces.



Use a quality concrete mix, placed in 12-inch, even layers. Spade or vibrate to settle concrete. To prevent segregation in ready-mix, deliver at enough points to avoid long chuting distances.



Strip forms after concrete hardens. One or two days is usually long enough in summer—four to seven days in cold weather. Pull out or break off tie rods, patch holes with mortar.

What about condensation?

Often builders are blamed for leaky basements when the trouble is condensation. Avoid this by explaining that condensation can be controlled by ventilation, covering cold water pipes or installing a dehumidifying unit.

Paint all exterior walls with class "B" portland cement paint or two coats of hot bituminous material. To smooth interior surfaces, rub with carborundum stone and cement-water mix.

Place drain tile around the outside of the footing, except in dry climates or in extremely well-drained soils. Cover the tile with a 12-inch layer of coarse aggregate.

(continued from page 10)

are the outcome of a study conducted by the Building Research Advisory Board.

Moisture control is, of course, one of the most serious problems which arise in connection with slab-on-ground construction, and there is little doubt that most user dissatisfaction relates back in one way or another to the builder's failure to deal properly with this problem. The chief complaints on this score relate to the passage of excessive amounts of water vapor through the slabs, and to the too-frequent failure of floor covering materials due to actual transmission of moisture through slabs. Other problems are caused by slab movements sufficient to damage floors and other structural elements, and perimeter heat losses which may cause condensation difficulties and excessive fuel bills.

grading the site

The best way to deal with the several aspects of the moisture problem in connection with slab-on-ground construction is through preventive rather than corrective measures, and the key to prevention is usually to be found through studies of the site itself and of the characteristics of the soil. In short, successful slab-on-ground construction demands that the site be examined carefully from the standpoint of surface drainage and that such characteristics of the soil as capillarity and load-bearing capacity be determined. It is not too much to say that most of the serious trouble which has been experienced with this type of construction has resulted from careless planning, or total lack of planning, at the outset.

An essential requirement of effective site preparation is to provide surface drainage in every direction from the house, and in this connection the elevation of the slab above the finished grade is of the utmost importance. It is recommended that the finished grade at outside walls should be at least 8 inches below the top of the slab, when the slab is unheated or when heating coils are embedded in the concrete, and at least 2 inches below the bottom of ductwork next to foundation walls when warm air ducts are used in or under the slab.

The finished grade adjacent to slab-on-ground construction should when-

(continued on page 14)

MIXING WATER CAN BE COSTLY!

Water is used in concrete to lubricate the mix and act chemically with the cement to form the paste which glues the aggregates together. Too much water dilutes the paste and makes it weaker—less solid.

How Much is Too Much?

In a 5-bag concrete mix using about 36 gallons of water per cubic yard—including moisture in the aggregate—only about *half* the water combines with the cement. The rest is a lubricant which eventually causes voids in the concrete. Recommended slumps for different jobs are listed in the table at upper right.

Recommended Slumps for Various Types of Construction*

Type of Construction	Slump, in.**	
	Maximum	Minimum
Reinforced foundation walls and footings, and thin plain walls	5	2
Plain footings, caissons, and substructure walls	4	1
Slabs, beams, and reinforced walls	6	3
Building columns	6	3
Pavements	3	2
Heavy mass construction	3	1

*Adapted from Table 4 of the 1940 Joint Committee "Report on Recommended Practice and Standard Specifications for Concrete and Reinforced Concrete."

**When high-frequency vibrators are used, the values given should be reduced about one-third.

Results of Too Much Water in a Mix

1. Higher labor costs—When workmen have to wait for the mix to stiffen or for excess water to soak into the subgrade or evaporate, overtime costs run high. In cold weather, as much as 6 to 12 hours in extra time can be the result.

2. Excessive bleeding—As concrete bleeds, water comes to the surface. If there is excessive bleeding, the water brings aggregate fines to the surface which often causes dusting and crazing.

3. Sand-streaked walls—Excess water bleeds up the sides of forms, washing out the cement paste leaving a streaked, raw, unattractive wall surface.

4. Segregation—Coarse aggregates settle to the bottom, leaving a weak layer of water and fines on the surface. The lower sections of the concrete often have honeycombed areas because of cement-water paste leaking out of the forms.

5. Excessive cracking—Foundation walls and floors crack excessively from high shrinkage and low tensile strength caused by excessive mixing water.

6. Rough surface—It is more difficult to get a smooth surface because deep trowel marks are a common problem in concrete containing excessive amounts of water.

7. Leaky walls and wet floors—Both can result from excessive voids in concrete caused by too much water.

8. Surface scaling—Air is entrained in concrete to protect it from freezing and thawing damage. When the slump is greater than 6 inches, the air content decreases and this important protection is reduced.

Stiff concrete is much less expensive when measured in man hours. It may require more labor initially to get it in place but can be finished sooner . . . your bonus is a satisfied customer—and a good job that will not have to be repaired or replaced.

(continued from page 12)

ever possible provide a 12-inch drop in a distance of 25 feet in all directions, and this 4 percent slope should be maintained as a minimum when obstructions or property lines are encountered within 25 feet of the slab. Some positive method of drainage should be provided whenever the proximity of a driveway, terrace or other detail prevents the maintenance of a 4 percent slope. Grading of hillside building sites should be carried out in such a way as to divert surface water around slab-on-ground construction.

the slab bed

The two most common causes of moisture problems in slab-on-ground construction are water transfer by capillarity and the movement of water vapor from the soil beneath the slab. While proper drainage may take care of both of these problems, many building sites require additional protective measures. The use of granular materials under the slab will generally solve the problem of capillary water, and vapor transmission can be effectively and economically limited with any of a number of vapor barrier materials. The latter under some conditions will also provide a satisfactory stop for capillary water, but many jobs require both of these protective measures. It should also be noted that neither of these measures is likely to be successful on a building site which involves a hydrostatic pressure condition near (less than 6 inches from) the natural surface of the ground.

The distance which capillary water will rise from the water table varies for different types of soil. It ranges from a maximum of about 2½ feet for coarse sand to around 7½ feet for fine sand to 11½ feet for silt and clay. Dimensions of saturation zones, of course, run considerably less—from a little over 2 feet for coarse sand to perhaps 4½ feet for fine sand and around 5½ feet for clay and silt.

Obviously it is essential to know the type of soil with which you are dealing and the highest known level of the water table. If this information indicates that capillary water may reach the underside of the concrete slab, the use of a base material of limited capillarity should be considered. Except in definitely arid cli-

(continued on page 16)

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(continued from page 14)

mates, a limited capillarity base should probably be provided whenever the subsoil consists of clay or silt. Crushed stone, gravel and many coarse aggregate materials ¼ inch and larger form excellent capillary barriers, but it is often desirable to have such materials tested, particularly to determine the permanence of the protection they will provide.

If there is no need for a capillary break, the slab may be placed on foundation fill graded to the proper elevation and compacted in layers not more than 4 inches thick to assure uniform support. Topsoil, roots, vegetation and any other foreign matter should, of course, be removed completely, and the desired grade established with clean fill.

If conditions require a base of limited capillarity, the material selected for this purpose should be thoroughly compacted by either rolling or tamping. The resulting slab bed should be not less than 4 inches thick.

vapor barriers

Water vapor, which has a density only 1/205,000th that of water at 32 degrees F., can readily pass through most building materials, and it is recognized today as being one of the most destructive of the forces that attack the modern home. It is a more severe problem today than ever before because of the many ways in which modern construction successfully lowers heat transfer through walls, doors, windows and roofs. Since we have thus made it harder for water vapor to escape from our modern homes, it has become correspondingly important that we take steps to prevent it from entering. The alternative is a host of such costly household evils as buckled and mildewed floor coverings, peeling paint, rusted metals, crumbling plaster and rotting wood.

Most water vapor gets into a home through the ground area beneath the foundation. This is equally true of slab-on-ground and basement type construction. The ground area under an average home may release as much as 20 gallons of water in the form of water vapor each 24 hours—compared with around 3 gallons per day which may be created inside the home through all of the water-vapor-producing activities of a family of four people.

While there is mounting evidence to indicate that water vapor should be combated in some way in most types of residential construction, there are problems in connection with the use of certain flooring materials over concrete which make the inclusion of a suitable vapor barrier imperative. Wood floors of all types, cork tile, linoleum and all felt- or fabric-backed composition materials should be included under this heading. Asphalt, rubber, vinyl-asbestos, and flexible (unbacked) vinyl tiles all seem to get along equally well with or without a vapor barrier. However, if more than 20 percent of a slab is to be left exposed, the use of a vapor barrier should be regarded as mandatory.

There are many vapor barrier materials on the market today. They include papers, plastic films, combinations of paper and plastic film, felts, glass and mineral fibres, mineral aggregates, metals and asphalts. In selecting a particular material the user should be guided by the manufacturer's reputation, backed up whenever possible by his own experience. In addition

(continued on page 18)

How to Stretch a Buck... Use

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Your investment in forms can pay off in extra dollars saved when you use Symons Steel-Ply Forms. It's because Symons Steel-Plys are designed and built with performance features that cannot be found in other forms.

Completely Interchangeable

Any combination can be used . . . side by side or one on top of the other, for any length or height of wall. Panels can be removed and replaced at any point . . . this simplifies erecting and stripping.

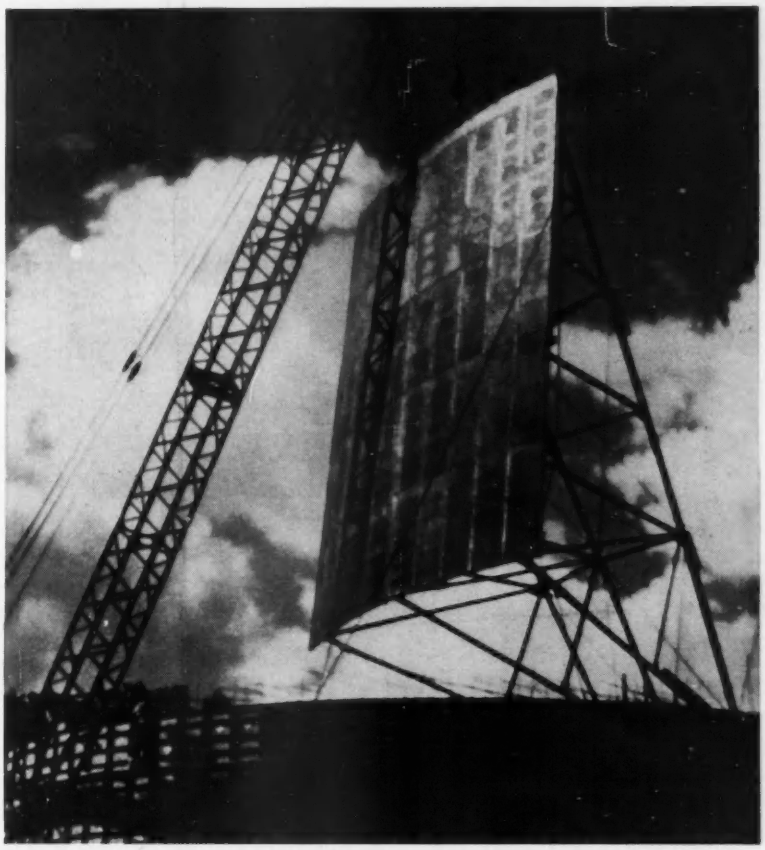
Weight 5 Lbs. Per Square Foot

When considering forms, the weight of the form is an all-important consideration. Because of the efficient methods developed for erecting and stripping forms, handling is an important part of the labor cost. Symons Steel-Ply Form weight of 5 lbs. per square foot means a significant cut in form labor costs. Handling costs are also reduced because all Symons Steel-Plys are equipped with handles for easier and faster handling.

Ties To Fit The Job

With Symons Steel-Ply Forms you can get the tie that will be most economical for your particular job. For rough work where appearance and break-back are not important you can use the Symons flat tie. When clean-cut foundations and easy positive break-back are required, Symons Steel Rod Ties with 1" break-back are the answer. And, for special gang forming, Symons She-Bolt Ties with 1½" break-back are available.

37,000 square feet of steel-ply forms used on the Air Force Academy, Colorado Springs, Colorado.



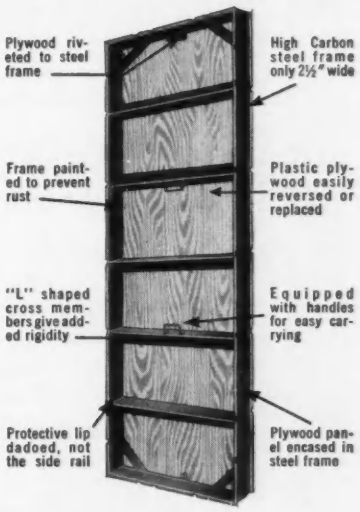
CIRCULAR WALLS were formed by ganging steel-ply forms. Four ganged sections 22' wide by 28' high were used to pour a third of the sewage treatment tank at one time.

Connecting Bolt and Wedge

For connecting hardware a bolt and wedge are used. With these two pieces you can fasten two forms together and insert the tie faster than driving a nail. Brace plates, scaffold brackets and waling hardware are also fastened with the bolt and wedge. This eliminates the need for dogs, nuts and bolts, lugs, vise grips, special tools, as well as complicated and expensive ties. The only tool needed is a hammer.

Adaptable For Every Type Construction

Contractors who use Symons Steel-Ply Forms can bid on almost any type concrete job. They are adaptable for straight, circular, battered, cut-up and "Y" walls. Try Symons Steel-Ply Forms on your next job; they can be rented with purchase option.



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(continued from page 16)

to providing an effective barrier against water vapor, the selected material should be capable of standing up under the rough handling and heavy traffic which are inevitable on all construction sites.

It is believed that the use of an effective vapor barrier also results in producing a concrete slab which is denser and more impermeable because sand and cement cannot filter down into the porous base material on which the slab rests. When it is desired to accomplish this purpose alone, a structural separator material can be used which may be less costly than a vapor barrier.

slab insulation

The entire perimeter of the slab in slab-on-ground construction should be insulated with a waterproofed, rigid material not less than 1 inch thick. When the highest known water table is less than 2 feet below grade, perimeter insulation should be placed in a horizontal position; otherwise the material may be positioned either horizontally or vertically, but in all cases the vertical edge of the slab should be insulated.

The material selected for perimeter insulation should not be permanently impaired by wetting, and it should be non-capillary. It should not be damaged by contact with wet concrete and it should be highly resistant to termite and fungus attack.

Vertical insulation can generally be 18 inches in length, this measurement being made from the bottom of the slab. In mild climates, however, this length may be reducible to 12 inches or even 6 inches. Vertical insulation should be increased inch for inch whenever the height of the foundation wall above grade exceeds 8 inches.

Most slab-on-grade designs require that horizontal (or L-type) insulation be 24 inches long, but exceptions may occur in connection with warm-air perimeter heating systems.

reinforcement

Few aspects of slab-on-ground construction are as likely to touch off debate as the question of reinforcement. Even the BRAB committee was not unanimous on this subject, but the final recommendation states that distributed steel reinforcing should be required for the following conditions:

(1) In all slabs supporting load-bearing partitions or partitions of substantial weight, if such partitions are located more than 4 feet from the center axes of the slab.
(2) In all slabs placed on fill more than 2 feet deep.
(3) In any slabs for which more than 10 percent of the area within the foundation wall has been excavated and backfilled.
(4) In all unheated slabs longer than 30 feet in their longest dimension.
(5) In all slabs in which heating ducts or pipes are imbedded.

The BRAB report makes these minimum recommendations for distributed steel in nominal 4-inch slabs without substantial partition loads (i. e., not more than 1000 pounds per foot):

10-gage at 6 inches in both directions for all heated slabs up to 45 feet long.

(continued on page 20)

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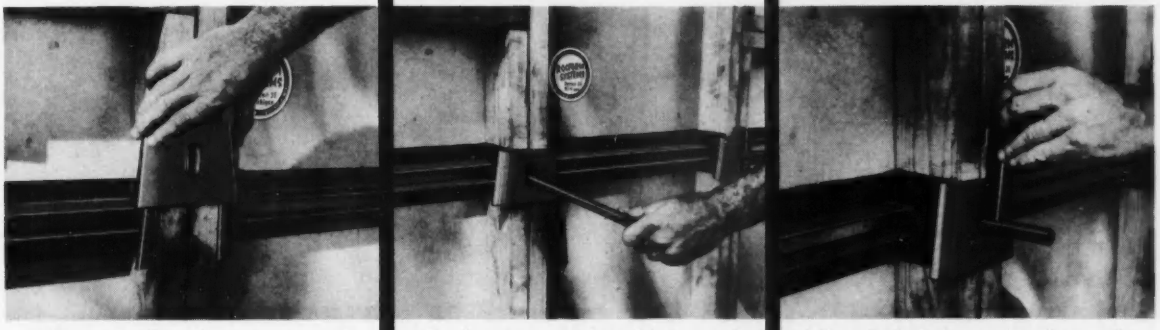

Clamp easily slips over metal-wedge ears of adjacent forms. One blow with hammer locks clamp.

Rocform tapered tie-rod is inserted through clamp and into clamp on opposite wall form.

Tie-rod pin is inserted and tapped with hammer to secure tie-rod which automatically gives desired wall thickness.

ROCFORM ADAPT-A-CLAMP PROVIDES THESE JOB-PROVEN FEATURES:

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Without sacrifice of the traditional Rocform standard of quality.

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Simplicity of hardware, complete absence of wood walers cut set-up time by 25% over any other system. One piece corner clamps simplify corner setup.

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Rocform Adapt-A-Clamp system can be purchased ready-mounted on panels or the Adapt-A-Clamp hardware can be purchased for use on existing panels. Adapt-A-Clamp is such a flexible system that it can be used with most any tie-rod or snap-tie produced today. Panels employing Adapt-A-Clamp can be stacked for tall commercial wall work. Stirrup pins available for catwalks or wood liners.

Financing arrangements, field training and service are all-continuing, customer-approved features associated with the Rocform Corporation. If you produce residential basements in quantity or do commercial structure wall work, you owe it to yourself to get full details on the Rocform Adapt-A-Clamp system. Call or write today. No obligation, of course.

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(continued from page 18)

10-gage at 6 inches for unheated slabs over 30 feet and up to 45 feet long.
8-gage at 6 inches for slabs over 45 feet and up to 55 feet long.
6-gage at 6 inches for slabs over 55 feet long.

When a partition transmits a total load of 1000 pounds per foot or more, and is located more than 4 feet from the slab center, the BRAB report recommends an increase in steel area perpendicular to the partition in the amount of 0.020 square inches per foot. Provision is also made for thickening slabs by 2 inches under partitions transmitting total loads of 1000 pounds per foot, and by 4 inches for partitions transmitting total loads of 1500 pounds per foot. A properly designed separate footing is recommended for all partitions or loads exceeding 1500 pounds per foot.

the slab itself

The ready mixed concrete used for the slab itself, as well as for any bearing partition footings required, should be made with a well-graded, durable aggregate. The total water content should not exceed 6 gallons per sack of cement, this amount including any water present in the fine aggregate.

In the absence of vapor barriers or separators, it is important (especially in hot weather) to sprinkle the slab bed to prevent excessive loss of water from the concrete. To reduce the danger of segregation, place the concrete against other concrete already in place whenever possible, avoiding excessive drops and long lateral movement. The minimum thickness of the slab should be 4 inches, and pipes or reinforcing within the slab should be covered by at least 1 inch of concrete.

After the concrete is placed on the slab bed, it should be compacted, either by vibrating or by tamping and spading, and then screeded to the proper grade. The surface should then be compacted by working it with a wood float to obtain an absolutely level surface. Steel troweling should be delayed until the sheen of water has disappeared from the surface of the concrete and then it should be done sparingly to avoid bringing an excessive amount of fine material to the surface.

(continued on page 21)

For L- or T-shaped slabs having offsets that exceed 10 feet, it is important to provide contraction joints where such offsets join the slab proper. Some builders also believe that very large slabs should be divided into smaller units by locating dummy contraction joints at partitions and other points where the appearance of such joints will not be objectionable.

The necessary duration of moist curing will vary somewhat with the time of year, and it will also need to be somewhat longer when the slab is to be left exposed. The BRAB report has this to say on the subject: "During the early hardening period of 10 days to 2 weeks, moisture for wet curing should be provided, or steps taken to prevent the evaporation of existing moisture in the mix." The same report also urges that the concrete be protected from freezing and rapid drying during the curing period. It is recommended that 60 days elapse between the placing of concrete and the application of flooring materials, but the minimum time specified is 30 days.

conclusion

Good slab-on-ground construction appears to hinge to a considerable extent on the willingness of the designer and the builder to exercise the same sound judgment required for other types of construction, plus a little extra emphasis on the moisture problem. Indeed, it would seem that if the vogue of slab-on-ground work had done nothing else than draw attention to the importance of moisture control in ALL types of concrete construction, it has perhaps served a most useful purpose.

Some builders object to the emphasis which slab-on-ground construction places on the need for careful study of building sites and soil conditions, but here again there is a mountain of evidence to support the notion that every such effort exerted in the planning stages is bound to pay off in the construction stages—by speeding up work and by preventing the costly failures which do so much to impair the reputation of concrete.

Readers who would like to have additional detailed information concerning slab-on-ground construction for residences should obtain a copy of BRAB publication 385 by sending $2.00 to the Building Research Advisory Board, 2101 Constitution Avenue, Washington 25, D. C. END

letters

suggestions wanted

Sir:

Congratulations on the article appearing in the September issue of CONCRETE CONSTRUCTION Magazine entitled "Step Down to More Living Space." It is the best review of residential basement construction that I have read.

We are attempting to promote additional uses of concrete in home construction. Recently we started using television advertising as a medium to increase the use of concrete for driveways, patios and swimming pools.

Our approach to the construction of basements has been handicapped by the local feeling that basements are dark and damp. The suggestion in the article to provide a belt course of windows around the top of the basement will greatly improve ventilation and lighting. However, we would like the opinion of the author for the exterior treatment of the house where these windows are involved. Inclusion of the windows will mean that part of the elevation of the basement is above ground level, which will require a one-story house to have an exterior appearance different from the ordinary. In this area one-story houses with a low profile are popular. Now, what are your suggestions for accomplishing the low appearance and still have the basement windows? We realize that our question to you should normally be referred to an architect, but the author displayed through the article such a keen insight into basement construction that we felt that our question had been considered previously. Thanks for your splendid magazine. We hope you have more articles on basement construction.

R. O. EVANS
Concrete Supply Co.
Charlotte, N. C.

suggestions offered

Sir:

CONCRETE CONSTRUCTION Magazine has sent me a copy of your letter in which you pointed out that you are concerned with the problem of improving ventilation and day-lighting in the basement area, and at the same

time, building in keeping with the popular trend toward a low profile. As you anticipated, we too have considered this problem. We have found that in pre-planning basements there are certain rules that apply to all basement building. One rule is that the basement family room or recreational area should always be at the rear of the house, since the furniture and games in this area should serve a dual purpose for indoor and outdoor activity. Since it is the normal thing to build outdoor living areas or patios away from the street side of a home, or at each end of a home, we would suggest that the windows not be placed on the street side of a basement. The grade in front of the house can then be crowned to make the house look as though it is sitting lower in the ground.

We realize that many architects have leaned towards the slab-type house for two reasons: (1) for economy, and (2) because they believe it is ideal to walk in or out of a home at grade level. Most builders know that $1500 will build a fairly good sized basement, and that they cannot duplicate equal space above ground for the same money. If basement space is money saving, it is then we must consider modifying the advantage of stepping out of a home at grade level. Why not consider the one-step-up floor level at the front of a home, and a three-step differential between grade and the first floor at the rear? This makes possible the installation of a series of windows 3 feet long by 20 inches high with a supporting post every 3 feet to hold the first floor plate. These windows will then provide daylight and ventilation to an area that was formerly served by 4 or 5 small windows with area walls. If the above arrangement presents a land drainage problem, then the solution might be to set the first floor 30 inches higher than the grade, or paint the foundation and the house in the same color. In the case of concrete block construction, there is no dividing line to indicate where the basement ends, and the house begins, and this kind of house presents no problem in regard to providing a low silhouette

Enclosed you will find some of our

(continued page 24)

literature together with our "basement pre-planning" booklet which may give you some additional ideas. I hope that some of the suggestions made here will be of help to you, and that you will do some experimenting along these lines. I also hope that you may be convinced of the importance of direct to the yard accessibility provided by our Bilco basement doors, and that you will try one on your next model home.

At the National Builders Show in Chicago last January, I told many builders this story, and they went away convinced that they would try some houses with more windows and better access as provided by our Bilco door. It is my belief that a better planned basement area can provide a strong means of selling "more living space for the money" for prospective home buyers.

If any photographs of your future model homes embody the use of direct access ventilation and day-lighting, we would sincerely appreciate having them.

GEORGE W. LYONS, JR.
The Bilco Company
New Haven, Conn.

Puget Sound contractors organize

Sir:

Since writing you on September 2, the contractors in this area have formed the Puget Sound Concrete Contractors Association. Twenty contractors signed as charter members, nine have since requested admittance, and fifteen others have indicated an interest. A draft of the proposed by-laws is to be referred to the executive board for study and recommendation. Elected as officers and members of the board were: *president,* Robert Smith of MacKenzie & Smith; *vice-president,* Fred Naslund of Grover Naslund & Co.; John Shue of Shue & Johnson; W. B. Ableman of Skyway Cement Construction; and Floyd Nixon of G. L. Nixon. The undersigned was named as executive secretary and manager and member of the board and all committees without vote.

B. M. BRYANT
Puget Sound Concrete Contractors Association
Seattle, Washington

book reviews

Advantages and Disadvantages of Auto Fleet Leasing. *Published by The Foundation for Management Research, 121 West Adams Street, Chicago 3, Ill. 27 pp. Free on request.*

This study deals with one- and two-year auto fleet leasing. The statistics it presents indicate that auto leasing by industry has increased sharply in the last decade. Tables in the report show at what point it is worthwhile for a company to use its own working capital to purchase an auto fleet, and at what point it is more worthwhile to lease an auto fleet. In using salesmen-owned cars, many companies are not being guided by cost considerations. Tables in the study indicate at what annual mileage, and at what cents-per-mile rate, salesmen owned cars are cheaper than leased cars, and vice versa. According to the study, the outlook is that auto fleet leasing will slowly displace most company-owned cars and about half the salesmen-owned cars used by industry.

Report on Cooperative Freezing-and-Thawing Tests on Concrete. Special Report 47. *Published by Highway Research Board, 2101 Constitution Avenue, Washington 25, D. C. 67 pp. Illus. $1.60.*

The Highway Research Board Committee on Durability of Concrete—Physical Aspects, began in 1947 to develop a procedure for conducting a rapid but highly discriminating freezing-and-thawing test for concrete. The American Society for Testing Materials had published four tentative test methods. The material presented in this report resulted from a program of cooperative freezing-and-thawing tests of concrete specimens conducted by thirteen laboratories using the four tentative methods of test.

It was concluded that these methods provide useful procedures for comparing the relative durability of different concretes within a given laboratory;

(continued page 26)

that a wide variation of results in the middle range of durability appears to be a normal characteristic of the methods; that the data do not permit recommending one test method over the others for all purposes; and that the ability of concrete to withstand a severe laboratory freezing-and-thawing test is probable indication of a high degree of durability.

Industrial Building Details. *By Duane F. Roycraft. Published by F. W. Dodge Corporation, 119 West 40th Street, New York 18, N. Y. 356 pp. Illus. $12.75.*

This sourcebook of industrial architectural details for architects, designers, draftsmen, and engineers presents over 1,500 architectural details for the contemporary industrial building. The author, architect Duane F. Roycraft, started a number of years ago to record those architectural details he found most useful in his work. The collection was first published privately for friends and associates. This new book is a much expanded, revised extension of this earlier work.

The author has included those industrial details which he believes will be most useful, timesaving, and universal in their application. They cover every part of the industrial building, and include structural details, walls, windows, louvers, roofs, parapets, monitors, floors, ventilators, stack curbs, expansion joints, flashing, canopies, doors, door frames, stairs, ladders, platforms, hatch covers, manholes, storage and transport facilities, and many more.

Handbook of Heavy Construction. *Editor-in-Chief, Frank W. Stubbs, Jr. Published by McGraw-Hill Book Company, Inc., 327 West 41st Street, New York 36, N. Y. 1040 pp. Illus. $18.50.*

Now available in this handbook is convenient reference to the methods, data, and working information needed in all branches of heavy construction. Contractors, engineers, and others will find answers to a wide range of practical problems concerned with earthmoving, concrete, steel erection, highways, foundations, and other areas of the field.

Thirty-six specialists supply expert guidance in estimating the requirements of a construction job, performing major field operations, operating and maintaining equipment, and making the best use of modern materials. Tables of data for figuring costs of operating and owning equipment, output of equipment, economical use of materials, and other cost factors are included.

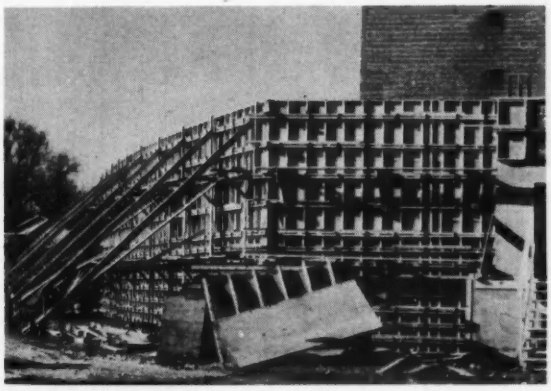
Written in practical terms, with particular stress on cost, materials, procedures, equipment, schedules, controls, design and operation, the book contains chapters on: excavators, tunnels, explosives, dewatering, pneumatically applied concrete, precast and prestressed concrete, intrusion grouting, electric-arc welding, timber construction, bituminous pavements, pipelines, cofferdams and caissons, pile driving, river diversion, construction contracts, safety, and contractor's organization.

products

For further information use check list on page 31.

curing blanket

Designed to protect newly placed concrete during curing, this curing blanket is a fine-fibered, flexible, resilient, felt-like blanket of fibrous glass bonded with a thermosetting resin, completely enclosed in a tough 8 mil black polyethylene film. Owens-Corning Fiberglas Corp.

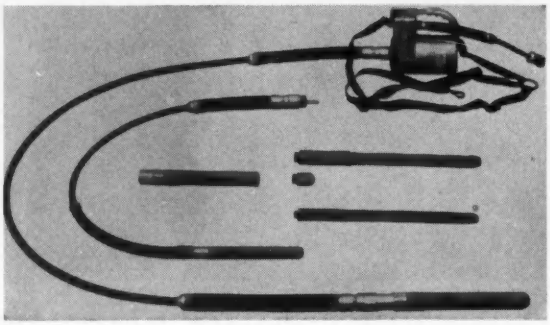


high density plywood forms

High density plywood forms are put into position for a pour at the new Kimberly-Clark Corporation warehouse at Neenah, Wisconsin. Because this material is a premium product the contractor pointed out that good workmanship and special care are essential to make sure the higher cost of this plywood is offset by smoother concrete, lower finishing costs and longer form life. The surface is much tougher than ordinary plywood, but it can still be damaged by carelessness in handling, setting steel and conduit, or by improper use of vibrators. Since it costs about twice as much as regular plywood, the contractor figures the break-even point occurs on the twelfth or thirteenth pour; after that the overlaid forms begin to pay dividends. Some of the forms have survived 25 to 50 pours and are still usable. The secret behind the large number of pours these forms can withstand lies in the moisture resistance of the panels and the care used in handling the forms between pours. Kimberly-Clark Corp.

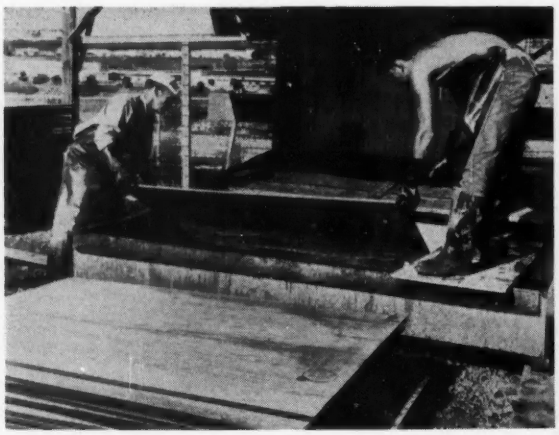
products

For further information use check list on page 31.



adjustable vibrator

New flexible-shaft vibrator has twin variable eccentric for variation of amplitude and frequency as required. Other features: removable steel or rubber tips for head, spear tips for tight spots in prestress work, adjustable carrying strap for motor. Champion Mfg. Co.



dipping speeds form coating

Two men can coat a fir plywood concrete form panel with concrete form sealer in three minutes by a dipping method developed by Engstrum & Nourse, San Francisco contractors. The panels are dipped in a galvanized steel trough long enough to accommodate a 10-foot panel. The trough is filled with several inches of form sealer. After dipping, the panels are stood on edge on the rack in the background. Stacking with stickers allows the panels to dry out ready for use the following day. The system can be used either in a contractor's yard or on a job site. It recently helped speed construction of dormitories for San Francisco State College. Douglas Fir Plywood Association.

products

For further information use check list on page 31.

steel ply catalog

New 16-page catalog contains detailed descriptions of steel-ply forms, which are available in sizes from 3 to 8 feet, as well as accessories such as fillers, corners, stoop forms, pilasters, and ties. Also shown are applications of the forms in slab forming, gang forming, circular walls, battered walls, lo-wall forming and culvert forming. Symons Clamp & Mfg. Co.

belt conveyors

Conveyors, pre-engineered and shop-assembled from matched Link-Belt components, are described in a new 40-page handbook, 2779. Conveyors are adaptable to a large proportion of belt conveyor applications and operating conditions. Selection of the right equipment can be made quickly and easily. Link-Belt Co.

concrete vibrator

A 1½-inch diameter head vibrator is recommended for prestressed and post-stressed sections and a 2½-inch diameter head model may be used for any job from 6-inch sections to mass concrete. Vibrators utilize low amplitude, high frequency vibration. Absence of bearings eliminates maintenance problems. Motor is in head and vibrator is operated by one man. Pacific Mercury, Equipment Div.

products

For further information use check list on page 31.

portable heater

Oil furnace on wheels blows air around outside of completely enclosed combustion chamber and is said to produce large volume of heated fresh air instantly. Fumes can be vented out top. Ducts can be provided to pipe heat to areas for spot heating. Built-in thermostat permits selection of temperature. Safety controls eliminate need for attendant. Stow Mfg. Co.

jitterbug crawler

Booklet describes how a tool for concrete finishing tamps a slab without requiring workman to wade in the mix or over-pound a low slump mix. Tool is said to speed finishing time and reduce concrete finishing costs. Goldblatt Tool Co.

repair material

Field-tests on Plastic-Mastic, an epoxy-polyamide general repair material, are claimed to have shown it to be a practical and economical repair material with virtually unlimited applications in industrial maintenance. Williamson Adhesives.

etcher

An acid in brown powder form, when dissolved in water, will etch concrete prior to painting or scarify and roughen smooth concrete surfaces before repair or resurfacing, assuring good bond between new and old surfaces. St, Louis Laboratories.

admixture

A concentrated, balanced, liquid compound of basic multiphase wetting elements is added to dry mix at the rate of 4 ounces per cubic yard before mixing water is added. It is said to bring about complete hydration of all the cement and thorough wetting of aggregate. About 15 percent less water is required for the same slump, better plasticity is attained, strength is increased and 3½ percent air entrainment results. Deynor Corp.

Check boxes below and on next page for information on products described in this issue

See mailing instructions on next page.

☐ **sealant**

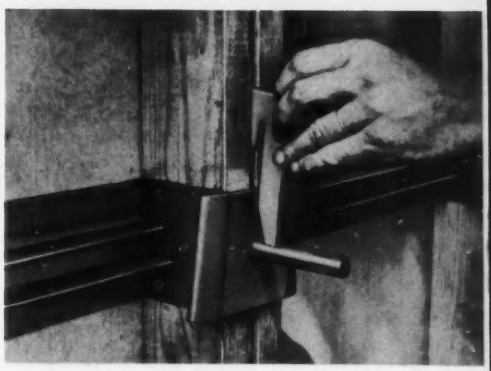
Folder provides an installation guide by type of surface for a sealer which contains no wax, paraffin, oil, soap, silicate of soda or varnish, and leaves no sticky residue or greasy film on surfaces. Said to provide positive protection from moisture damage to a wide variety of surfaces, and to be excellent as a coating for concrete forms. E. A. Thompson Co.

☐ **handbook**

1959 building construction and maintenance handbook contains engineering data and specifications to help solve many problems of waterproofing, dampproofing, painting, caulking, roofing and flooring. Included in book are 36 pages of tables and charts, materials, estimating guide, weights and measures, paint and concrete work, information of value to architects, engineers, building owners and managers, specification writers, contractors and building supply dealers. Index to products and uses provides quick reference. L. Sonneborn Sons.

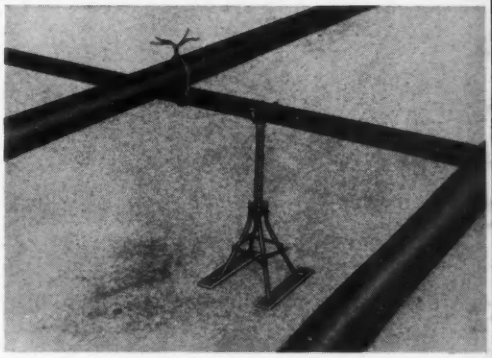
☐ **form clamp**

Clamping system is said to be less expensive than previous hardware, contain fewer components per panel and yet produce excellent finished walls. Rigid panels are maintained by permanently attached metal reinforcing channels. Panels are connected by wedge-shaped clamps which engage complementary wedge-shaped ears protruding from exterior upright panel members. Rocform Corp.



☐ **screed chair**

A system of radiant heating pipe installation which is said to reduce time and material costs makes use of a screed chair. On a Clinton, Ohio project, the slab was placed on a sand base, graded in two directions. Accurate positioning of radiant pipes in the slab was complicated by 2-way grading of slab. The fast adjustment feature of screed chairs provided a solution. Dayton Sure Grip & Shore Co.



☐ **power buggy**

Available with either a 10-cubic foot-bucket or a flat pallet, a power buggy carries a 1500-pound payload. Unit is 31 inches wide, and features 4-wheeled stability and dead man brake. Aeroil Products Co.

☐ **paving vibrators**

In-use photos illustrate a folder which describes a complete line of vibratory equipment for concrete street, highway and airport paving jobs. These vibrators operate completely submerged below concrete surface and are said to assure uniformly homogeneous mixture of aggregate and mortar from base to surface in slabs from 2 to 36 inches deep. Maginniss Power Tool Co.

☐ **prestress strand**

Brochure on prestressed concrete strand includes data on mechanical properties, load table, description of standard reels, load elongation tables, ASTM specifications for uncoated 7-wire stress-relieved strand for prestressed concrete, and descriptions of CF & I prestressed concrete wire, tie wire, welded wire fabric, and reinforcing bars. Colorado Fuel and Iron Corp.

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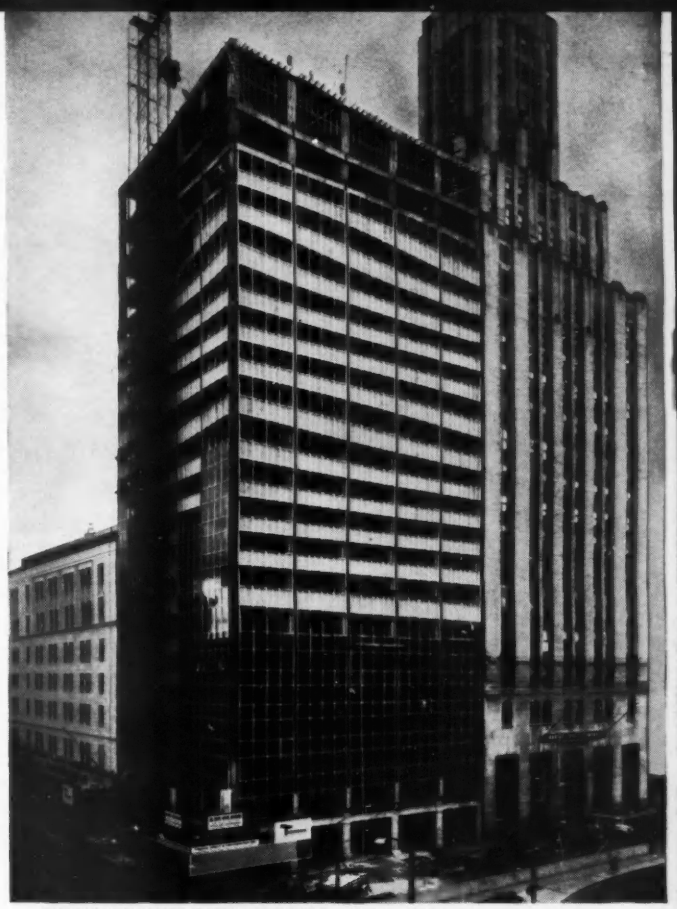
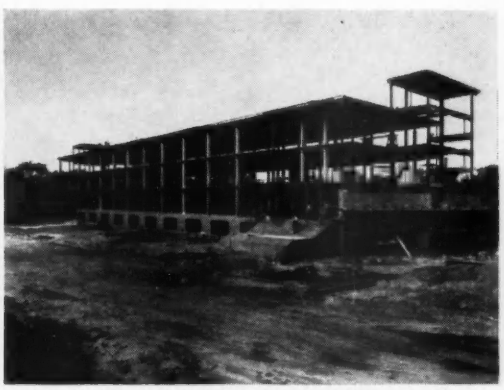


TISHMAN REALTY OFFICE BUILDING—lightweight aggregate concrete • Architect: Emery Roth & Sons, New York • Structural Engineer: Farkas & Barron, New York • Contractor: Dic Construction Co., Elmont, L. I. • Lightweight aggregate: Anchor Concrete Products Inc., Buffalo • POZZOLITH Ready-Mixed Concrete: Pine Hill Concrete Mix Corp., Buffalo.

UFFALO EVENING NEWS BUILDING • Architect: Villiam Ginsberg Associates, New York • ontractor: Siegfried Construction Co., Inc., uffalo • POZZOLITH Ready-Mixed Concrete: uffalo Crushed Stone Corp., Buffalo.



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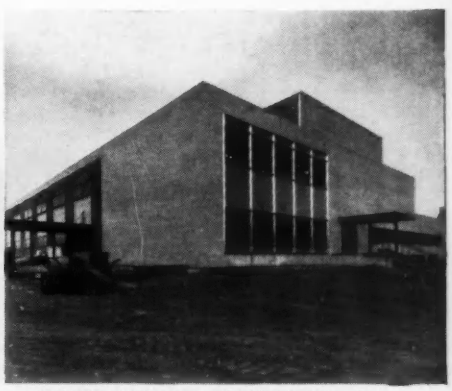

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None of the several hundred complex subjects discussed in each issue of Concrete Construction Magazine is covered exhaustively in the sense that ALL of the needs and questions of EVERY reader are answered. There wouldn't be enough paper in the whole of creation to publish a single issue which could accomplish this purpose.

To broaden the magazine's service to its audience, there are self-mailing inquiry pages in the back of each issue. Their purpose is to provide an effortless means through which any reader may obtain additional information on any subject covered—or, indeed, even on subjects not even mentioned in the particular issue. Since the inquiry page is perforated, it is a simple matter to remove it, check off the items on which additional information is desired, provide a name and address in the space indicated, fold up the sheet and drop it in a mail box. It isn't even necesssary to hunt for a stamp, since the publisher pays the postage for mailing from any place in the United States.

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